FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

PROXIMITY ALERT SYSTEM

MODEL NUMBER: PAS-400

REPORT NUMBER: R10505763-RF2A

FCC ID: 2AELU-PAS400

ISSUE DATE: 2015-10-27

Prepared for
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Revision History

Ver.	Issue Date	Revisions	Revised By
1	2015-07-21	Initial Issue	Jeff Moser
2	2015-09-10	Revised to change Antenna information on page 6.	Jeff Moser
3	2015-10-27	Revised Occupied Bandwidth plot.	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PYOTT-BOONE ELECTRONICS INC
1459 WITTENS MILL RD
NORTH TAZEWELL, VA, 24630, USA

EUT DESCRIPTION: PROXIMITY ALERT SYSTEM

MODEL: PAS-400

SERIAL NUMBER: Non Serialized

DATE TESTED: 2015-02-16 to 2015-02-18, 2015-06-12, 2015-07-15, 2015-10-27

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	Pass

UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL LLC based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released
For UL LLC By:

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test	Uncertainty
Conducted Emissions (0.150-30MHz)	+/- 2.37 dB
Radiated Emissions (30-1000 MHz)	+/- 6.04 dB (3m)

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Proximity Alert System that contains an inductive loop system for the 122 kHz radio contained in the PAS-400.

The EM transceiver is manufactured by Pyott Boone Electronics, Inc.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum output peak E-field as follows:

Radio	Frequency Range (MHz)	Mode	PEAK Output E-field Strength (dBuV/m)	AVERAGE Output E-field Strength (dBuV/m)
PAS-400	0.122	Tx	24.50	10.90

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes one integral loop coil antenna, with an area of 0.007 square meters.

5.4. SOFTWARE AND FIRMWARE

Note: These program names are the official PBE numbers assigned to these programs when they are called out in the sub-assemblies during production.

(PAS-400 program) The firmware installed in the EUT during testing was 500-2489-001, rev. **-**.

For the supporting equipment, the following software/firmware was used:

(PAS-200 program) The EUT driver software installed in the host support equipment during testing was 500-2486-001, rev. **-**.

(PAS-100 program) The test utility software used during testing was 500-2488-001, rev. 1.43.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case configuration is determined to be when only one PAS-400 is connected to the PAS-300.

The transceiver must transmit and receive for proper functionality of PAS so there is only one mode of operation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Use	Product Type	Manufacturer	Model	Comments
EUT	Proximity Alert System	Pyott Boone Electronics	PAS	Consists of following
EUT	PAS Electromagnetic Transceiver	Pyott Boone Electronics	PAS-400	SN - Non serialized
AE	PAS Controller	Pyott Boone Electronics	PAS-100	SN - Non serialized
AE	PAS Aggregator	Pyott Boone Electronics	PAS-200	SN - Non serialized
AE	PAS Power Junction Box	Pyott Boone Electronics	PAS-300	SN - Non serialized
AE	PAS Texting Tag	Pyott Boone Electronics	PAS-500	SN - Non serialized
Note: **EUT** - Equipment Under Test, **AE** - Auxiliary/Associated Equipment, or **SIM** - Simulator (Not Subjected to Test)				

I/O CABLES

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	-	-	None.
1	PAS-400 DC/Data Port (from PAS-300)	DC-I/O	Y	N	None.
	Support Gear				
2	PAS-300 Battery Input Port	DC	Y	N	None.
3	PAS-300 Ignition Port	DC	Y	N	None.
4	PAS-300 Aggregator Port (DC/Data) to PAS-200	DC-I/O	N	N	None.
5	PAS-300 Front Port (to the PAS-400)	DC-I/O	Y	N	None.
6	PAS-200 DC/Data (DC In / Data from PAS-300 Aggregator Port)	DC-I/O	N	N	None.
7	PAS-200 Ethernet	I/O	Y	N	None.
8	PAS-200 DC Controller Power	DC	Y	N	None.
9	PAS-100 Ethernet	I/O	Y	N	None.
10	PAS-100 DC Power	DC	Y	N	None.
11	PAS-100 Light Bar Cable	DC-I/O	N	N	None.
12	PAS-300 Opto Isolated DC Inputs	DC	N	N	None.
13	PAS-300 SPDT Relay	DC	N	N	None.
14	PAS-300 Ignition	DC	N	N	None.
15	PE	DC	Y	N	None.

Note:
AC = AC Power Port DC = DC Power Port N/E = Non-Electrical
I/O = Signal Input or Output Port (Not Involved in Process Control)
TP = Telecommunication Ports

TEST SETUP

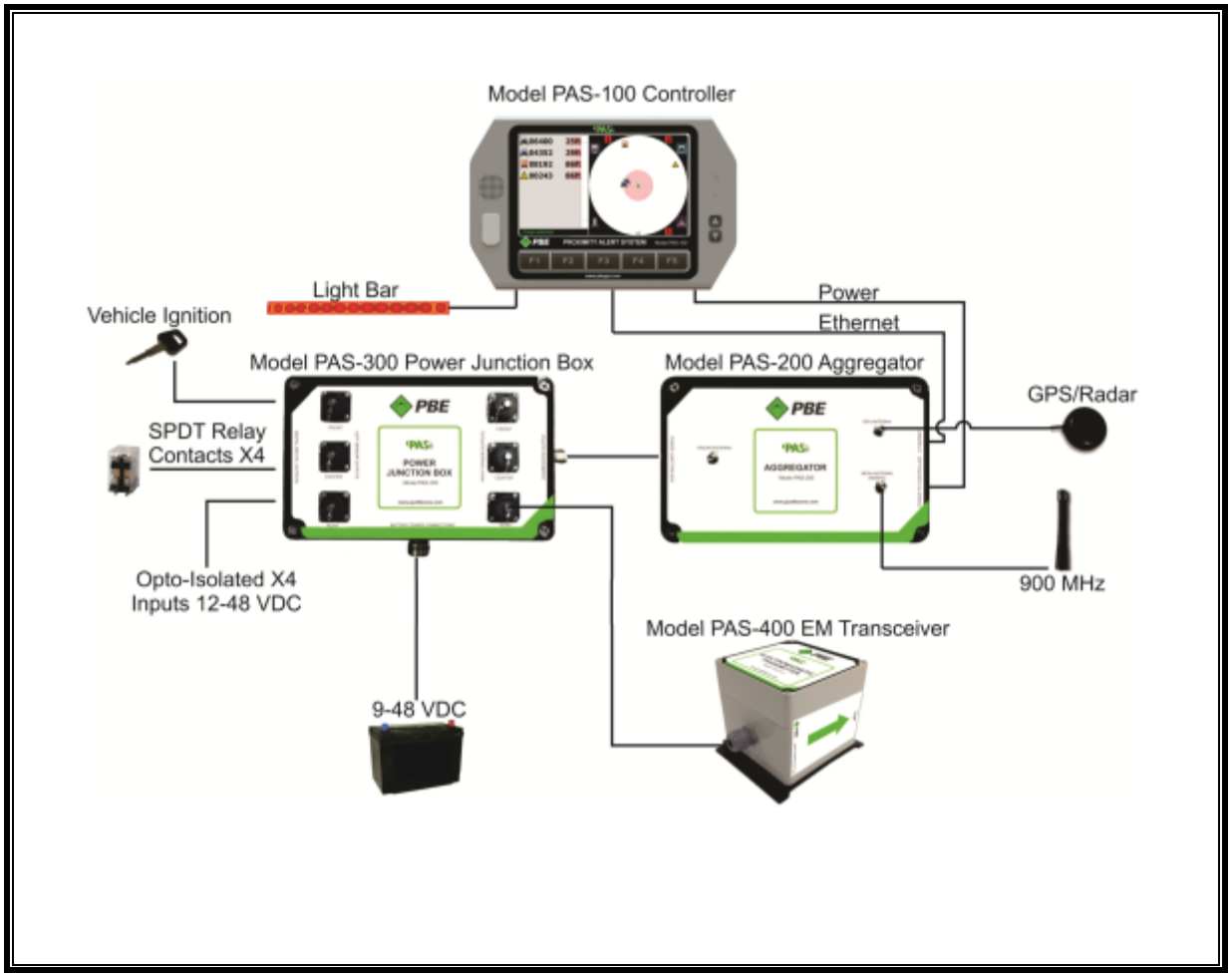
The EUT (PAS-400) must be installed in conjunction with the rest of PAS. (PAS-100, 200, 300)

The EUT was connected to the PAS-100 through the PAS-200 and PAS-300.
The PAS program was used to test the PAS-400.

The EUT has an integral EM transceiver; therefore the PAS-500 tag or another PAS-400 were used to test the PAS-400.

PAS was setup to run under normal operating conditions as shown in the block diagram below. The PAS-500 tag was set approximately 4 to 5 feet from the PAS-400 to verify detection. The battery and ignition inputs were both powered by a UL provided power supply. The PAS-100 detection screen was used to monitor the equipment detection during tests to verify it functionality.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Radiated Disturbance Emissions (E-field)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0037	Loop Antenna (Low Range)	Electro-Metrics	EM-6871	2015-01-26	2016-01-26
ATA013	Coaxial cable, 20 ft., BNC -male to BNC-male	UL	RG-223	2014-09-05	2015-09-30
AT0022	Log-periodic Antenna, 200 MHz to 1000 MHz	Chase	UPA6109	2015-05-16	2016-05-31
AT0025	Biconical Antenna, 30 to 300 MHz	Schaffner-Chase EMC Ltd.	VBA6106A	2014-07-01	2015-07-31
SAC_C (Biconical 3m location)	Gain-Loss string for biconical antenna at 3m	Various	Various	2014-09-03	2015-09-30
SAC_D (Log-Periodic 3m location)	Gain-Loss string for log-periodic antenna at 3m	Various	Various	2014-07-17	2015-07-31
SAC_E_LR (Loop & Rod 3m location)	Gain-Loss string for loop/rod antenna at 3m	Various	Various	2014-07-17	2015-07-31
	Receiver & Software				
SAR003	Spectrum Analyzer / Receiver	Rohde & Schwarz	ESIB40 (1088.7490.40)	2014-07-14	2015-07-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
SA0025	Spectrum Analyzer	Agilent	N9030A	2015-03-27	2016-03-31
*SA0026	Spectrum Analyzer	Agilent	N9030A	2015-03-27	2016-03-31
	Additional Equipment used				
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-02-19	2015-02-28

*Equipment used for Occupied Bandwidth

7. RADIATED EMISSION TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.209 (a)

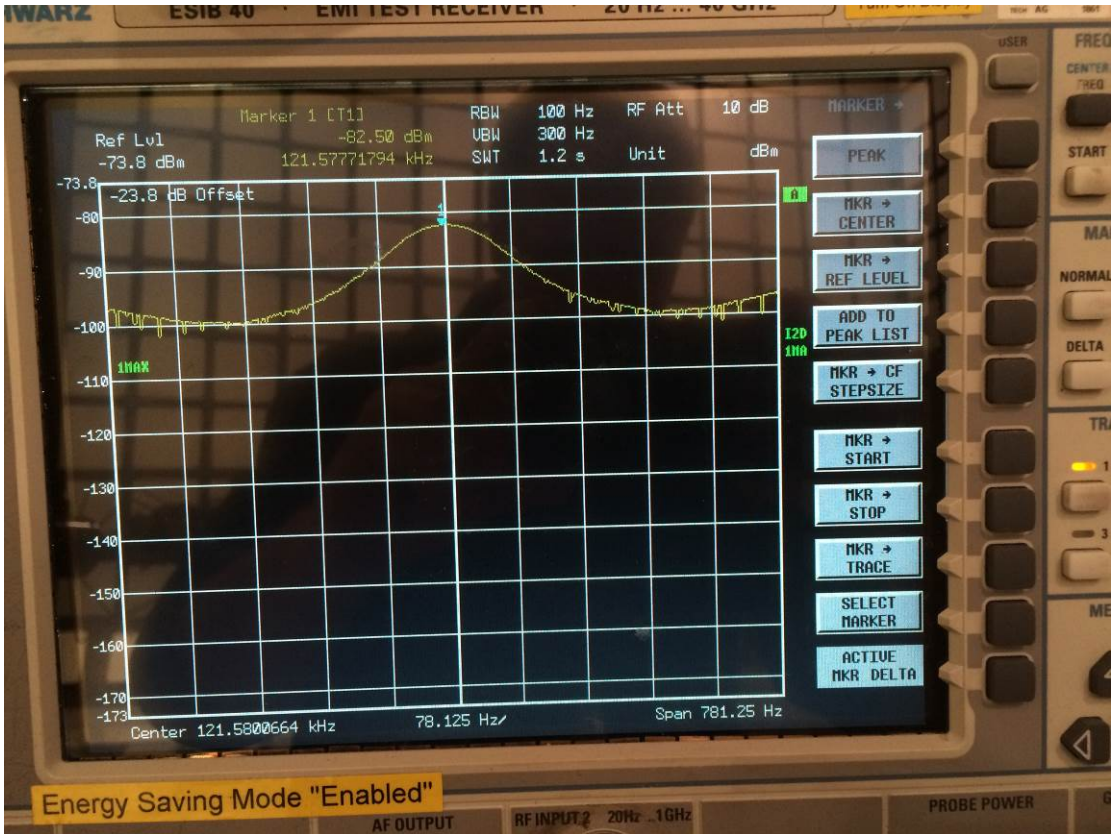
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Note: The lower limit shall apply at the transition frequency.		

Note 1 – Fundamental is 122 kHz, therefore the limit is 19.67 uV/m or 25.88 dBuV/m
Note 2 – The distance correction below 30 MHz is 40logx/d where is x = measurement distance and d = specified measurement distance

Therefore, assuming a measurement distance of 3m, the following are the Distance Correction.
0.009-0.490 MHz = -80 dB
0.490 – 1.705 MHz = -40 dB
1.705-30 MHz = -40 dB

RESULTS

7.2. FUNDAMENTAL MEASUREMENT



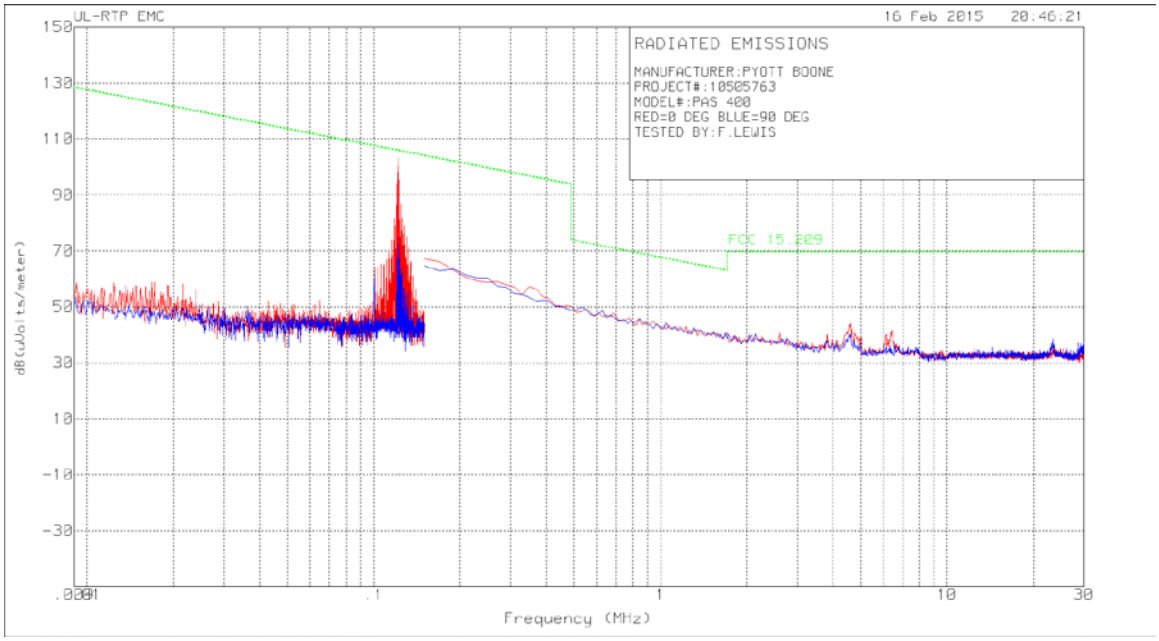
Test Freq. [MHz]	Meter Reading [dBm]	dBm to dBuV	Detector*	Antenna [dB/m]	Gain/ Loss [dB]	DCF (dB)	E-Field [dBuV/m]	Limit [dBuV/m]	Margin [dB]
0.12158	-58.8	48.2	PK	56.2	0.1	-80	24.5	-	-
0.12158	-72.4	34.6	AV	56.2	0.1	-80	10.9	25.88	-14.98
*PK = Peak, QP = Quasi-Peak, AV = Average. DCF = Distance Correction Factor.									

7.3. TX SPURIOUS EMISSIONS 0.15 TO 30 MHz

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (specification distance / test distance).

PLOT

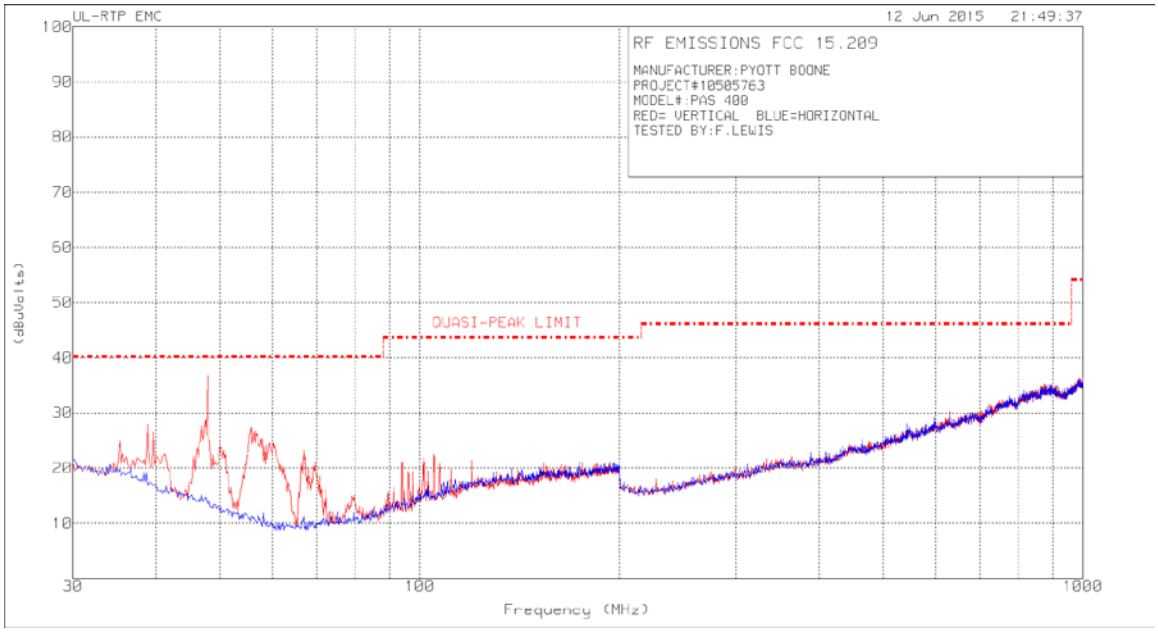


DATA

Test Frequency [MHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/Loss [dB]	Field Strength [dBuV/m]	FCC 15.209 [dBuV/m]	Margin [dB]	Polarity	Azimuth
0.12161	47.2	Pk	56.0	-0.1	103.1	-	-	0	0-360
0.10027	8.3	Pk	55.9	-0.1	64.1	107.6	-43.5	0	0-360
0.12453	31.0	Pk	56.0	-0.1	86.9	105.7	-18.8	0	0-360
4.61051	7.7	Pk	36.3	0.1	44.1	69.5	-25.4	0	0-360
0.10027	5.6	Pk	55.9	-0.1	61.4	107.6	-46.2	90	0-360
0.12161	18.8	Pk	56.0	-0.1	74.7	105.9	-31.2	90	0-360
*PK = Peak, QP = Quasi-Peak, AV = Average.									

7.4. TX SPURIOUS EMISSION 30 TO 1000 MHz

PLOT



DATA

Test Frequency [MHz]	Meter Reading [dBuV]	Detector*	Antenna [dB/m]	Gain/ Loss [dB]	Field Strength [dBuV/m]	FCC 15.209 [dBuV/m]	Margin [dB]	Azimuth	Antenna Height (cm)	Polarity
35.2753	35.5	Pk	15.6	-24.2	26.9	40.0	-13.1	0-360	100	V
38.8488	39.7	Pk	14.2	-24.3	29.6	40.0	-10.4	0-360	100	V
47.6241	33.2	QP	10.7	-24.1	19.8	40.0	-20.2	3	156	V
55.6957	45.7	Pk	7.4	-24.1	29.0	40.0	-11.0	0-360	100	V
66.7567	42.7	Pk	6.1	-24.0	24.8	40.0	-15.2	0-360	100	V
105.0450	35.7	Pk	11.8	-23.8	23.7	43.5	-19.9	0-360	100	V
*PK = Peak, QP = Quasi-Peak										

7.4.1. 20 dB BANDWIDTH

LIMITS

FCC §15.215 (c)

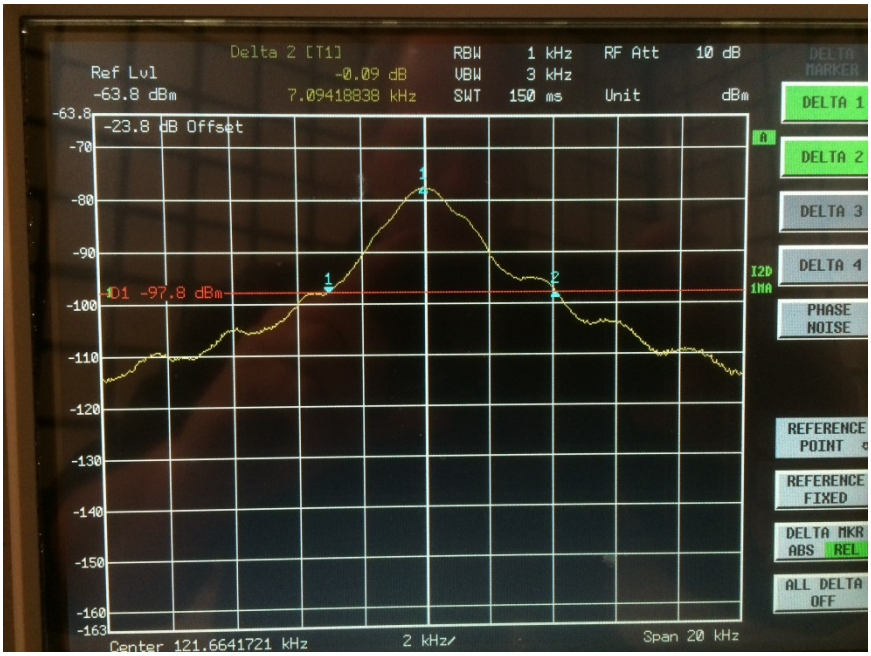
The minimum 20 dB bandwidth was reported below.

RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)
-	0.1215	0.00709

20 dB BANDWIDTH

20 dB BANDWIDTH



7.4.1. 99% BANDWIDTH

LIMITS

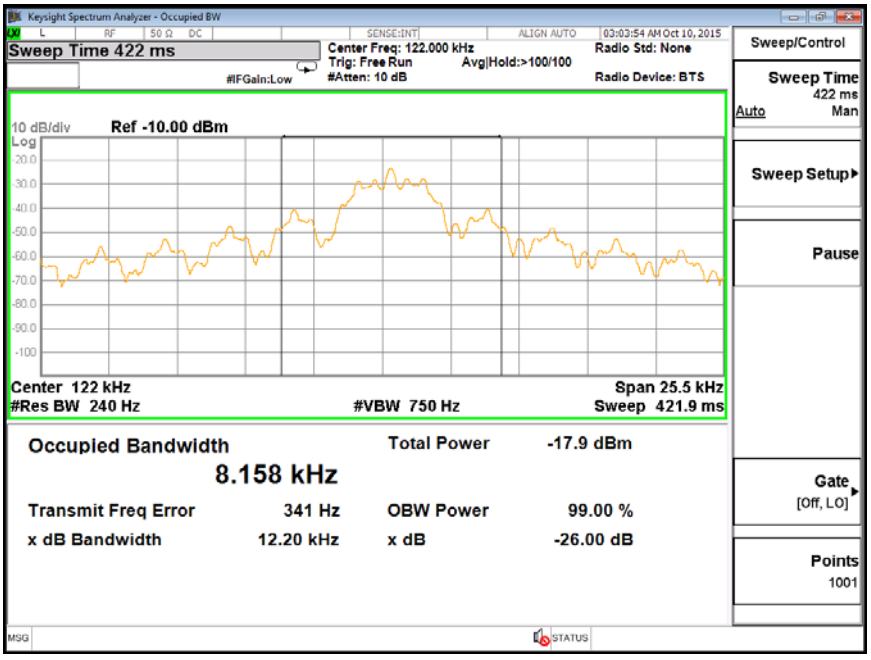
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
-	0.1220	0.008158

99% BANDWIDTH

99% BANDWIDTH LOW CH



END OF REPORT